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Forest fires and PM₁₀ pollution: the March 2012 case in Northern Spain

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Forest fires are one of the largest sources of particulate matter, carbon monoxide, volatile organic compounds and other pollutants at regional scale. They significantly impact on local air quality and human health, even far from their original sources.

March 2012 was one of the largest fire activity late winter and early spring seasons across northern Spain and Portugal. Official statistics from the Spanish and Portuguese authorities show that, during that month, approximately 35.000 ha were burned, representing the top March season in Cantabria (N. Spain) and the northern districts of Portugal since 1981, most of them occurring in the mountainous areas, as depicted from the FIRMS database (<https://firms.modaps.eosdis.nasa.gov/>). At the same time, an analysis of the pollution data (Airbase dataset; <http://www.eea.europa.eu/>) show an increase in PM₁₀ average values and exceedences of the limit values across the same area simultaneously or immediately after the main fire activity episodes. A comprehensive analysis of this fire and pollution event was undertaken to analyze the possible contribution of forest fires and other sources of PM₁₀ to the high levels of this pollutant at ground level. Besides statistics of fire activity, satellite “hot spots” and ground level pollution data, we have included in our analysis meteorological records (synoptic stations, upper air soundings), backtrajectories (<http://ready.arl.noaa.gov/HYSPLIT.php>) and dust forecast models (<https://www.bsc.es/earth-sciences/mineral-dust/catalogo-datos-dust>).

The results show a good agreement between the spatial and temporal variability of the levels of PM₁₀ and the direction of the pollution plumes downwind the forest fires. The activity was mostly concentrated during 3 events, the first one between February 25th to March 3rd; the second spanning from 10th to 17th, and the last one, the most severe of the three, at the end of March. The climatological background was favourable, because most of the Iberian Peninsula recorded severe moisture deficits at the end of the winter, as shown by the drought indices. At synoptic time scale, the episodes of generalized burning coincided with warmer and drier than usual conditions, although wind speed was low, in agreement with the prevailing stable atmosphere.

Saharian dust advections seem to have an indirect contribution to the high levels of PM₁₀, probably by resuspension of old air masses. Moreover, the possible advection of old polluted layers from Eastern Europe, through a European blocking circulation (cut off high), is also considered.